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1. Your reference

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3. Full name, address and postcode of the or of each applicant (underline all surnames)

Spicket Valves and Pumps Limited
Lawpark Farm
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Kilmacoll
Renfrewshire
PA13 4TA

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

8639981001

4. Title of the invention

Piston Rod Assembly

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Kennedys Patent Agency Limited
Floor 5, Queens House
29 St Vincent Place
Glasgow
G1 2DT

Patents ADP number (if you know it)

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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

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Priority application number
(if you know it)Date of filing
(day / month / year)**7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application**

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Date of filing
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- a) any applicant named in part 3 is not an inventor, or
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Continuation sheets of this form

Description

9

Claim(s)

Abstract

Drawing(s)

2

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Priority documents

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 3/77)

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I/We request the grant of a patent on the basis of this application.

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12. Name and daytime telephone number of person to contact in the United Kingdom

Arlene Campbell

Tel: 0141 226 6826

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1 PISTON ROD ASSEMBLY

2

3 This invention relates to high pressure reciprocating
4 pumps such as those used to pump drilling mud in the oil
5 production industry, including those pumps commonly
6 referred to in the industry as mud and slush pumps. In
7 particular, the invention relates to a piston rod
8 assembly, suitable for rapid replacement between a power
9 end and a fluid end of a reciprocating pump.

10

11 It is necessary with high pressure reciprocating pumps
12 to replace the piston or other dynamic component with
13 relative regularity and it is therefore advantageous if
14 this task can be performed quickly and easily. Typical
15 quick release piston rod assemblies, such as those
16 disclosed in GB 2,190,170 and US 5,904,701, have axially
17 arranged links to the power and fluid ends, held in place
18 by radial pins. Tension is then applied to the pins via
19 axial pistons to couple the fluid and power ends
20 together.

21

22 A disadvantage of these assemblies is that connectors
23 with suitably sized apertures must be arranged at each of

1 the power and fluid ends. The use of radial pins, to
2 which longitudinal tension is applied, provides weak
3 points on the assembly which can be prone to fracture
4 during high reciprocation. A further disadvantage of
5 these assemblies is that the relative angle between the
6 power end and fluid end must be taken into account when
7 positioning the assembly.

8

9 It is an object of the present invention to provide a
10 piston rod assembly which obviates at least some of the
11 disadvantages of the prior art.

12

13 According to the present invention there is provided a
14 piston rod assembly, for coupling between a power end and
15 a fluid end of a high pressure reciprocating pump, the
16 assembly comprising one or more clamping members arranged
17 relative a rod axis between the power end and the fluid
18 end, each member having a first end adapted to grip a
19 power end component and a second end adapted to grip a
20 fluid end component, at least one member including one or
21 more tensioning means, wherein said tensioning means
22 comprise a piston to provide a load in said tensioning
23 means orthogonal to said first rod axis and thereby
24 secure said components against release.

25

26 Preferably the clamping members are part cylindrical
27 bodies which when arranged on the rod axis provide a
28 substantially cylindrical body. Preferably there are two
29 clamping members, an upper clamping member and a lower
30 clamping member.

31

32 Preferably the first and second ends include a contact
33 face parallel to the rod axis on an inner surface.

1 Preferably the face provides a recess on the inner
2 surface in which a portion of the power end component or
3 fluid end component may be located such that the
4 component is gripped and held when the clamping members
5 are brought together by the tensioning means.
6 Advantageously each component end and the first/second
7 end provide a knuckle joint. Alternatively, they may
8 provide a ball and socket.

9
10 This clamping is obtained without any need of relative
11 angle position between the power end component and the
12 fluid end component. Further when the load is applied on
13 the rod axis, the large contact area between the faces,
14 and the components provides a large mechanical advantage
15 thus facilitating a large force to solidly assemble the
16 parts together even when a maximum reciprocating force is
17 provided by the pump.

18
19 Preferably each piston is slideable within an hydraulic
20 cylinder. More preferably each piston includes a stem
21 adapted to receive a nut or a lock. Preferably said stems
22 extend from one clamping member through an aperture in an
23 adjacent clamping member. The nut may then engage the
24 stem to couple the clamping members. Preferably also a
25 spring is arranged within the hydraulic cylinder to
26 tension the said stem. Advantageously, the assembly
27 includes non-rotational means for preventing rotation of
28 said stem. The non-rotational means may be a pin locating
29 in a matching recess arranged parallel to the stem.

30

1 Preferably a space is defined between a base of the
2 cylinder and a base of the piston for accommodating
3 hydraulic fluid. Preferably the assembly includes a fluid
4 inlet port to permit the input of hydraulic fluid to the
5 cylinder. Advantageously a chamber may be included in
6 each member to provide a common feed for hydraulic fluid
7 to all cylinders within the member.

8

9 An embodiment of the present invention will be
10 described by way of example, with reference to the
11 accompanying drawings, in which:

12

13 Figure 1 is a sectional side elevation of a piston rod
14 assembly, according to an embodiment of the present
15 invention;

16

17 Figure 2 is a sectional schematic view of a fluid inlet
18 port of a piston rod assembly according to an embodiment
19 of the present invention; and

20

21 Figures 3a & 3b are sectional views of tensioning means
22 in first (3a) and second (3b) operating positions.

23

24 Reference is initially made to Figure 1 of the
25 drawings which illustrates a piston rod assembly,
26 generally indicated by reference numeral 10, according to
27 an embodiment of the present invention. Piston rod
28 assembly 10, is located between a power end component 12
29 and a fluid end component 14. The components 12, 14 form
30 parts of a high pressure reciprocating pump as will be
31 recognised by those skilled in the art. In particular the
32 piston rod assembly 10 can be used in a high pressure
33 reciprocating oilfield mud pump.

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The piston rod assembly 10 may be considered as a clamping link by virtue of its purpose i.e. to provide a releasable coupling between the power end component 12 and the fluid end component 14 which is secure during the high reciprocating force applied by the pump. Assembly 10 comprises two half-cylindrical clamps 16,18. Each clamp 16,18 has an inner planar surface 20,22 respectively. The surfaces 20,22 are arranged on and lie parallel to the rod axis. The rod axis is a central line located between the end components 12,14.

The piston rod assembly 10 includes two tensioning modules 24a,b to connect the clamps 16,18. Each tensioning module includes a piston 26a,b, a piston stem 28a,b, and a disc spring stack 30a,b arranged within a cylindrical housing 32a,b with the lower clamp 18. These elements 28,30,32 are all disposed orthogonally to the rod axis of the assembly 10. Covers 34a,b, held in place by screws 36a-d, close the housings 32a,b retaining the spring force. The upper clamp 16 includes apertures 38a,b through which extend the stems 28a,b from the lower clamp 18. Each aperture 38 widens to provide a lip 40a,b parallel to the rod axis. A nut 42a,b is screwed to the stem 28a,b and may be tightened against the lip 40a,b.

Below each piston 26a,b in a space defined by the base of the piston 26a,b and the base of the housing 32a,b is a fluid chamber 44a,b. Hydraulic fluid 46 may enter this chamber 44 and exert a force upon the piston 26a,b. The chambers are connected to a fluid line 48 located along the length of the assembly 10. The fluid

6

1 line 48 is sealed, but includes an inlet port 50
2 illustrated in Figure 2.

3

4 Referring to Figure 2, the inlet port 50 is now seen
5 in a perpendicular aspect. Like parts to those of Figure
6 1 have been given the same reference numeral to aid
7 clarity. A female connector 52 is located with the port
8 50. By inserting a male connector 54 into the female
9 connector 52 pressurising hydraulic fluid 46 can be
10 inserted into the fluid line 48. It will be recognised by
11 those skilled in the art that the fluid 48 may be
12 supplied from a reservoir 56, utilising a pump 58,
13 through a check valve 60. The connectors 52,54 are
14 preferably quick release connectors and the male
15 connector 54 is a differential pressure fastening, which
16 avoids the need to screw in any device, thus making the
17 task of pressurising and releasing very fast.

18

19 Returning to Figure 1, on the inner surface 20,22
20 are arranged recesses 62a,b. When the clamps 16,18 meet
21 the recesses 62a,b form circumferential grooves around
22 the inner surface 20,22 equidistantly from the rod axis.
23 Each component end 12,14 includes a protrusion 66,68
24 which may be likened to a door knob or knuckle in
25 profile. Each protrusion 66,68, lies within a recess
26 62a,b and a large contact surface area 64a,b is provided
27 between the protrusion 66,68 and the inner surface 20,22.
28 Additionally as each recess 62a,b has an angled surface
29 facing toward the ends 12,14 respectively, the
30 protrusions 66,68 are effectively gripped by the clamps
31 16,18. To aid the fitting of each protrusion 66,68 into
32 each recess 62a,b, bearing pads 70,72 are located at the
33 distal ends of the protrusions 66,68. The bearing pads

1 70,72 may be formed of a material which provides some
2 give and has a relatively high elastic modulus.

3

4 Reference is now made to Figures 3a and 3b. Like
5 parts to those of Figures 1 and 2 have been given
6 identical reference numerals to aid clarity. These
7 Figures show operating positions of the assembly and will
8 be described fully hereinafter. Additionally these
9 figures illustrate further features of the assembly 10.

10 An anti-rotation pin 74 is located within the base of the
11 piston 26 and extends into the base of the housing 32.
12 The anti-rotation pin 74 prevents the piston 26 rotating
13 during movement of the nut 42. Also included in the
14 assembly 10 is a grease nipple 76 as is known in the art.
15 The grease nipple 76 fills grease into the disc spring
16 stack 30 to protect the stack 30 from rust.

17

18 In use, the lower clamp 18 including the tensioning
19 modules 24 are located against protrusions 66,68 of a
20 power end component 12 and a fluid line component 14 of a
21 pump. The protrusions 66,68 rest in the recesses 62a,b.
22 the upper clap 16 is then placed over the lower clamp 18
23 such that the stems 28a,b locate through the apertures
24 38a,b respectively. Nuts 42a,b are located on the stems
25 28a,b and hand tightened to align the protrusions 66,68
26 against the surface 64a,b. This process can be done
27 without the need to ensure that the end components 12,14
28 are perfectly aligned as tightening the nuts 42 will
29 bring the ends 12,14 into alignment. Fluid 48 is then
30 introduced to the line 46. Pressure will consequently
31 build up in the chambers 44a,b and the pistons 26a,b will
32 be forced upwards by a short distance, orthogonal to the
33 rod axis. This is illustrated in Figure 3a. The nuts

1 42a,b are given freedom to be tightened by further
2 rotation along the stems 28a,b towards the lips 40a,b. It
3 should be noted that the apparatus and method described
4 herein allows the nuts 40a,b to be tightened by hand by
5 means of a socket wrench. It will be appreciated that
6 this is a considerable advantage over the requirement of
7 using heavy tools.

8

9 When fluid pressure in the chambers 44a,b is released
10 by removal of the fluid 46, the pistons 26a,b are pushed
11 outwards towards the base of the housing 30a,b by the
12 spring stacks 30a,b. This places in shear the clamps
13 16,18 and the bearing pads 70,72. The end components
14 12,14 are now securely attached to the clamping link or
15 assembly 10. This is illustrated in Figure 3b. Further
16 with the load applied on the rod axis, the large contact
17 area 64a,b between the surfaces 20,22 and the components
18 66,68 provides a large mechanical advantage thus
19 facilitating a large force to solidly assemble the parts
20 together even when a maximum reciprocating force is
21 provided by the pump.

22

23 These steps may be repeated any number of times to
24 release or couple the assembly 10 between the ends 12,14.

25

26 The principal advantage of the present invention is
27 that by applying a force orthogonally to the rod axis a
28 greater securing force is provided to clamp the assembly
29 to the component ends. This also dispenses with the need
30 to provide apertures through the end components for
31 locking pins.

32

1 A further advantage of the present invention is that in
2 bringing the clamps together to grip the ends, the ends
3 need not be in perfect alignment initially. Additionally
4 any dirt which becomes trapped between the clamps, will
5 merely provide a spacing which can be made up by the
6 stacking springs. In this way the dirt will not cause
7 loosening of the clamps during reciprocation of the pump
8 in use.

9

10 A yet further advantage of the present invention is
11 that the assembly can be quickly made up without the need
12 for heavy tool to tighten the nuts.

13

14 It will be appreciated by those skilled in the art that
15 various modifications may be made to the invention herein
16 described without departing from the scope thereof. For
17 example, any number of tensioning modules may be
18 incorporated, as could numbers of clamps depending on the
19 shape of the protrusions at each of the ends.

20 Additionally, though spring stacks have been used to
21 provide tension in the piston housings, other elastic
22 members could be substituted. Further, a water flushing
23 pipe as is known in the art may be incorporated to remove
24 dirt and provide lubrication and cooling to the system.

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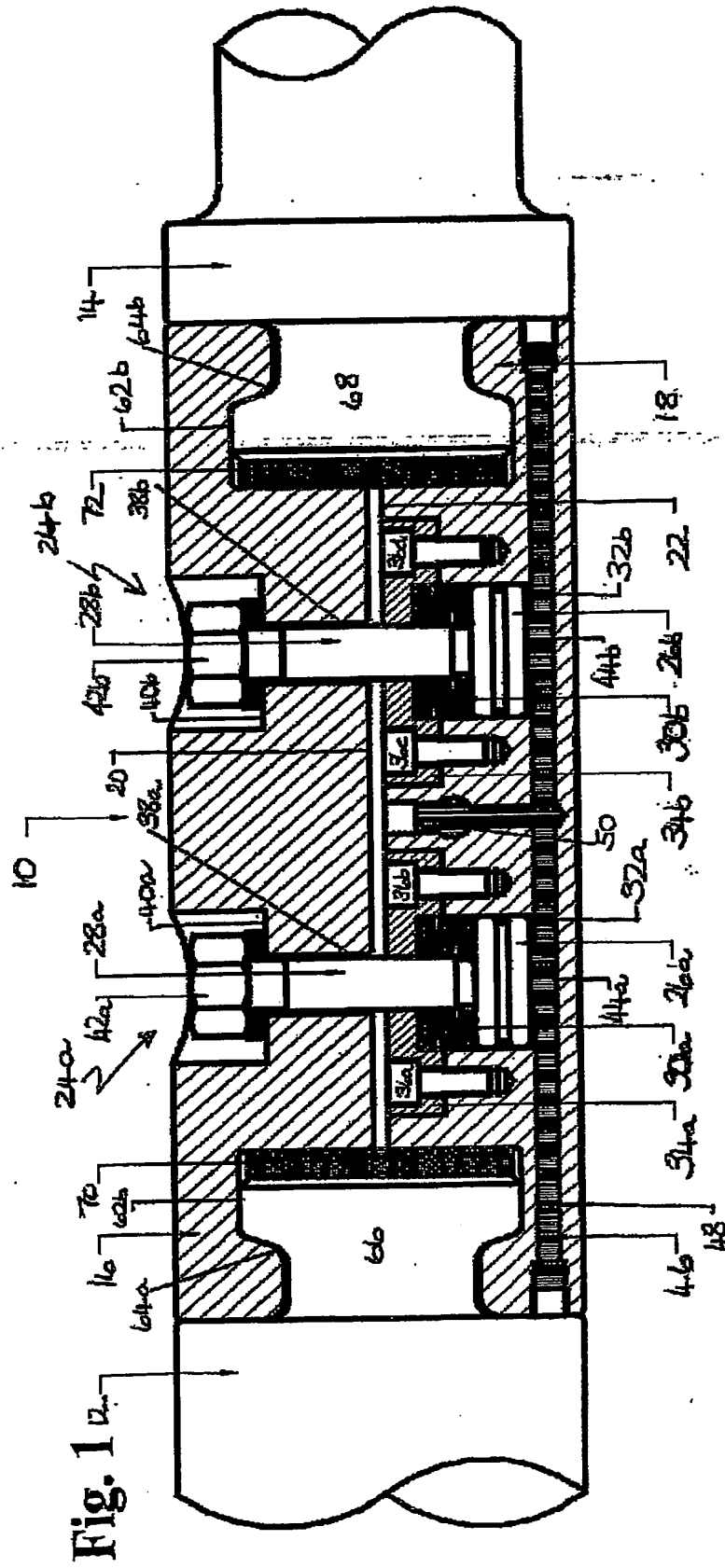
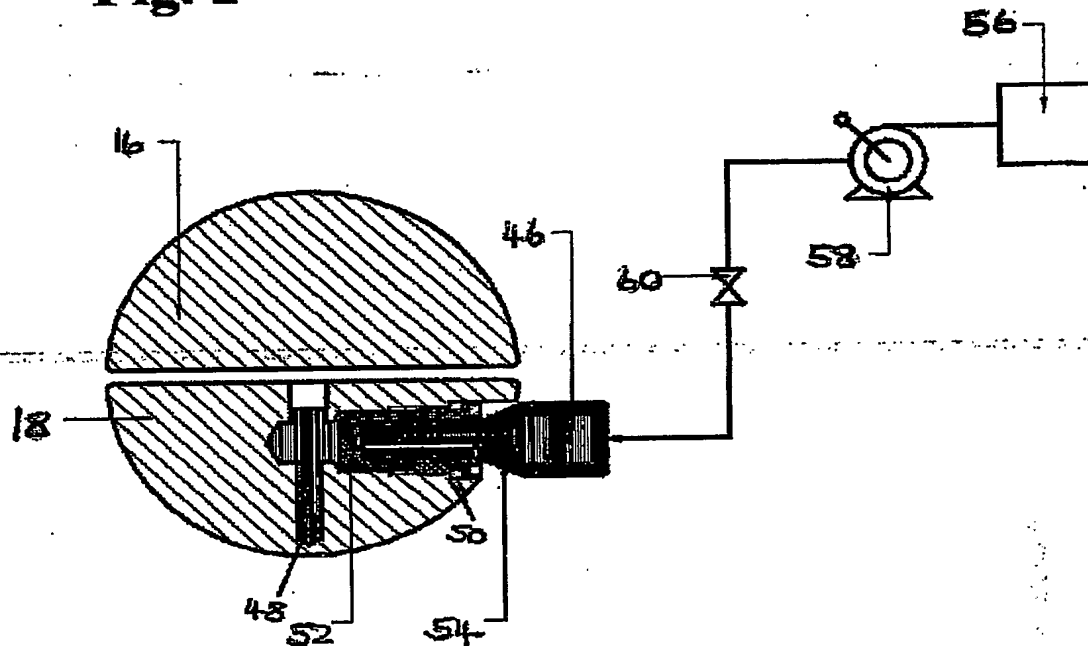
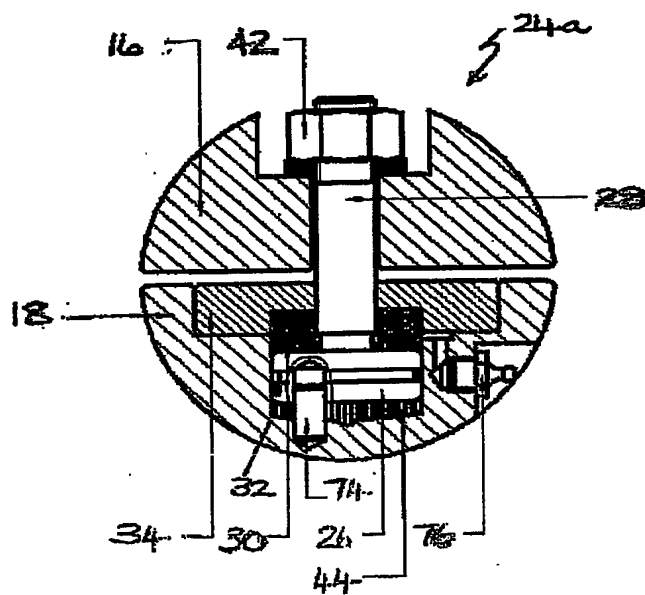
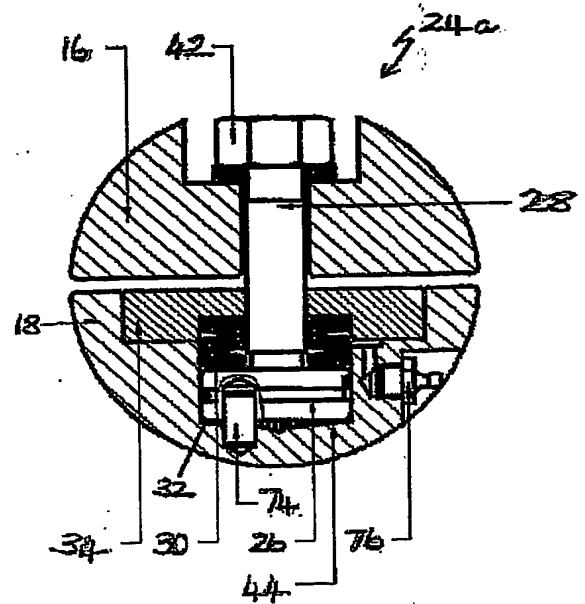


Fig. 1

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Fig. 2**Fig. 3a****Fig. 3b**

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